

AUTOMATION AND ITS IMPACT ON WOMEN ASSEMBLERS IN
MALAYSIAN FACTORIES

A Thesis

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ABSTRACT

Much has been written about the deskilling impact of technology on factory workers, especially since the publication of Harry Braverman's *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. This paper seeks to complicate the simplistic notion that technological advances in factories deskill workers. Focusing on women assemblers who were employed in large numbers in the 1980s in Malaysian factories for their alleged 'feminine skills', such as manual dexterity, and low labor costs, this paper argues that technological changes do not deskill women workers per se. Rather, these changes require new skills. As such, some women are able to find better employment in, for instance, clerical and managerial occupations. Others, however, lose out when changes are implemented because employers no longer associate these new skills, such as numeracy and literacy, with women. With these changes, they have to compete with men, resulting in the decreased proportion of women assemblers and a lowering of women's wages. It is also observed that some women move out of the formal labor force into casual work as companies outsource to home-workers to reduce production costs. As such, despite the observation that technology does not deskill per se, women workers bear the negative consequences of technological changes.

BIOGRAPHICAL SKETCH

Ee Mae Lim grew up in Kuala Lumpur. She received her B.A. Degree in the History and Philosophy of Science from Cambridge, England. She is interested in the growth of technology and its impact on society in general. She started her Master's Degree in Asian Studies in Fall 2008 and completed the following summer. Having finished her studies, she will be returning to Singapore to work with the government.

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CHAPTER 1

INTRODUCTION

The early labor-intensive phases of export-oriented industrialization in the developing world, particularly in South/ Southeast Asia and Latin America, between the 1970s and 1980s were curiously feminized. Women comprised the bulk of assembly workers (Ong 1987, Standing 1999, Kaur 2004, Caraway 2007). This trend of feminization, according to Standing (1999), can be defined as a “pattern of employment [that] tends to result in an increasing proportion of women occupying the jobs” (p.583). It occurs because, as Standing notes, “available employment and labor options tend increasingly to characterize activities... rightly or wrongly, with women” (ibid). The classical work on feminization of the labor force is Braverman’s *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (1974). Braverman theorized that mechanization deskills the work process as it becomes fragmented and as mental and manual labor become segregated. Employers, associating deskilled work and cheap labor with women, then hire women to replace men.

Although there is much debate on the causes of feminization during the early phases of export-oriented industrialization in developing countries, the trend itself is neither new nor difficult to deny. Historians of labor and of technology have documented various phases of feminization during the early phases of mechanization in the United States and Britain in the 19th and 20th centuries (Dublin 1979, McGaw 1987, Baron 1989). Given this pattern, various scholars have looked at how technological development have impacted women workers in terms of their wages, lifestyles, health and bargaining abilities (Eisold 1984, Ong 1987). More relevantly, scholars have also

looked at how technological changes have affected the skills of women workers – whether women are deskilled, as in Braverman’s argument, or otherwise. This paper is aimed at contributing to the latter body of literature by focusing on technological changes and their impact on the skills of women assemblers in Malaysia.

Most authors have accepted Braverman’s argument that, with automation of work processes, workers become deskilled. For instance, writing on Mexican women, Lourdes Beneria argues that these workers lose skills because automation changes the work process (2003). As a result, new skills are required for which women are not trained. This argument builds on Braverman’s thesis but is different. It does not assume that work processes merely become simpler, as Braverman does. Rather, it proposes that the work itself changes, requiring new sets of skills (1974).

Taking Malaysia as a case study, I build my thesis on Beneria’s argument. However, rather than arguing that women workers become deskilled, I hypothesize that women assemblers gain other skills with technological changes. These new skills may or may not allow them to retain their current or obtain new jobs.

Malaysia makes a good case, having moved rapidly from an agriculture- to an industry-based economy between the 1970s and 1980s. By the 1990s, the country was experiencing rapid growth in manufacturing, producing goods for overseas firms. Two sectors that grew in significance, contributing to a large proportion of the country’s exports and Gross Domestic Product, are the electronics and textile sectors. During the initial growth phase between the 1970s and 1980s, the work processes of these sectors were labor intensive, requiring large numbers of women assemblers. However, from

the mid-1980s onwards, these factories gradually became capital-intensive as firms began to automate and to introduce flexible production strategies in their production lines to increase output and efficiency. At the same time, the number of women workers, although still large, appeared to have declined. This paper, then, seeks to answer the question of how technological changes, in particular automation and flexible production techniques, along the assembly lines of electronics and textile factories affected the skills of women workers within the Malaysian context.

The results of the study have important consequences for scholars and policy makers. If it can be shown that women do not lose skills and yet their numbers in factories appear to be declining, scholars can focus on whether they are merely discriminated against in factory employment or are finding employment elsewhere. If the latter is the case, it is important to know whether the quality of their employment is improving or whether they have merely moved into less palatable forms of employment.

The layout of the rest of the paper is as follows. The second chapter reviews and deconstructs the relevant literature. The third provides the context of the industrialization process before the implementation of the new technologies such as automation within the electronics and textile sectors. The focus will be on the work processes and skill profile of women workers. The fourth discusses the implications of these new technologies in qualitative terms while the fifth provides empirical data to test the hypothesis that women are not deskilled per se with automation. The last concludes the study and suggests some policy implications or topics for future research.

CHAPTER 2

LITERATURE REVIEW

Theories of Feminization

Many scholars have built on Braverman's and Standing's theses on feminization. They propose that amongst the reasons for characterizing work processes with women is the repetitive nature of work, "requiring high levels of accuracy", especially within some labor-intensive sectors, like the manufacture of textile, garments, plastic and electronics. According to this view, employers associated women laborers with "manual dexterity, and... a light touch [which] embody the kinds of tasks [they] traditionally carried out" and, hence, appropriated them for repetitive, tedious manual work. In addition, these authors claim that women's "psychological make-up, passivity, docility, controllability and a capacity for hard work" and acceptance of lower wage levels further encouraged the mass mobilization of women into factories as low-level assemblers or production workers (Kaur 2004, pp.117-119).

Other scholars, however, have questioned the idea that women's supposed dexterity per se explains feminization. Writing on women workers in electronics and apparels factories in Ciudad Juarez, Mexico, Fernandez-Kelly argues that the mobilization of women into factories has more to do with the internationalization of capital. In her account, the penetration of capital through multinational companies into developing countries, "consistent with capitalist business rationale", is motivated by "wide wage differentials, the availability of what appears to be an inexhaustible supply of unskilled and semiskilled labor, high levels of productivity and a tractable work force". The conventional idea "government officials and personnel managers" hold that women

possess manual dexterity and docility appropriate for assembly work has little to do with reality. It is “mostly ideological... [constituting] a superimposed definition – of what men and women are able or unable to do – upon given material realities”. Thus, women are hired mostly because they “constitute a highly vulnerable, docile and manipulatable work force”, which has more to do with economic and political reasons than their supposed manual abilities per se (1983, pp.70-72).

While economic reasons and perceived dexterity may be important reasons behind feminization, identifying the cause as either one or the other poses the danger of over-generalization. Research by other feminist scholars has cast doubt on the simple assumption that either low wages or women’s alleged inherent traits alone are sufficient explanations. For instance, Caraway argues that while the aforementioned factors are important, they cannot be generalized. She shows how some employers employ women even though they are paid marginally higher wages compared to men. Furthermore, whether women actually possessed manual skills is irrelevant; “the crucial point is that employers believe that they do”. Hence, for Caraway, the gendered nature of assembly workers can only be understood in light of the relationship between “labor/capital intensity, labor supply, mediating institutions, and gendered discourses of work”. In short, only the inter-play between labor-intensive industrialization, cheap labor (low wages), the existence of institutions that mobilize women and the belief that some work processes are inherently feminine can holistically account for feminization of the workforce (2007, pp.14-35).

This study will build on Caraway’s proposal that feminization cannot be understood purely as a result of their low wages, supposed dexterity or ideologies of what

constitutes women's work. Rather, it is a complex relationship between these factors, which have varied relative importance at different times and places.

Braverman and the 'Deskilling' Thesis

Idealizing the past and craft skills, Braverman presents a pessimistic view of technological change, or more precisely mechanization, at the work place. The crux of his argument is that, with increasing mechanization in the twentieth century, laborers become detached from and gradually lose control over their work. This occurs because workers no longer can or need to understand the nature of what they do. Craft-like skills that characterize the pre-industrial period become obsolete as the machine takes over and as the laborer's job is reduced to the mere operation of the machine. The laborer, in effect, becomes deskilled of craftsmanship.

On the other end of the spectrum, however, are optimistic arguments aptly captured by the industrialization thesis (Kerr, Dunlop, Harbison and Myers 1964). Since industrialization requires a greater division of labor and increased automation to achieve higher productivity levels, the resulting technological change requires "a broader variety of skills and higher average skills... greater occupational and geographic mobility and an educational system that supplies the skills, training and specialization" (Spenner 1985, p.126).

Recent scholarship has highlighted several problems with both positions. First, the relationship between technological change in terms of increased automation and deskilling is less unilinear and deterministic than Braverman suggests. While some skills are lost, others, as the optimists argue, are created in the process (Wood 1982).

At the same time, neither can the optimists' position that technology naturally leads to upskilling be taken wholesale because, as the pessimists show, *some* skills are lost in the process. Both extreme positions also cannot be generalized because, as Spenner argues, whether workers experience upskilling or deskilling depend on a variety of factors "the level of automation... organizational milieu, the way management chooses to implement change and larger demographic and economic trends" (1985, p.128).

Thus, this paper will rest on a third position that recent scholarship has proposed but has yet to thoroughly develop. This position lies in between the two poles of the debate arguing that results are more often mixed. While some skills are lost, others may or may not be gained with technological changes (ibid).

While the focus of this study is on the changes in technology itself and the resulting impact on women's skills, it is not to deny that these changes do not affect management strategies or shop-floor activities. As Ng argues, "the advancement in the use of production technologies seem to go hand in hand with changing resource management and control techniques, as well as restructured shop-floor activities" (1998, p.97). As such, while changes in management strategy in response to technological upgrading will not be explicitly considered, they will not, at the same time, be dismissed.

In sum, this paper rests on the assumption that there is no determinate or easily generalizable relationship between technology and its effects on skills. Taking Spenner's position, I assume that "the impacts of technology on skills levels are *not*

simple, *not* necessarily direct, *not* constant across settings and firms, and *cannot* be considered in isolation” (1985, p.146).

The Concept of Skill

The notion of skill is often broad and undefined, which makes analysis difficult because different ideas of skill may be conflated. Wood argues that two important distinctions need to be made when analyzing skill. Following Beechey, he suggests that the first distinction is between the three different elements of skill; “(1) objectively defined competences, (2) control over conception and execution, and (3) socially-defined occupational status, which may be more or less independent of the level of objectively defined occupational competencies” while the second distinction is “between skill in individuals and the skill required in particular jobs” (1986, p.7). In this paper, skill will refer to the “objectively defined competences” of assembly or production workers. More specifically, the focus will be on women’s manual capabilities, whether in assembling and checking electronic components or sewing. This manual skill will also be treated as “skill required in particular jobs” rather than skill individuals possess. The second distinction is particularly important in this analysis because, as Wood suggests, “certain tasks may be deskilled in content because of technological changes, yet this may not amount to the deskilling of any particular individual” (ibid). Whether women workers actually lose dexterity with automation is not the main focus of this paper. Rather, the focus here is the loss of the requirement of these skills within the production process, which may or may not lead to the loss of dexterity amongst women assemblers.

Another concept of skill is that proposed by Gary Becker, who suggests that there is a distinction between the general and the specific (1980). General skills provided through general training, according to Becker, are those “useful in many firms besides those providing it” (ibid, p.19). Thus, general skills are abilities that can be applied in other firms to do similar jobs. Specialized skills, however, are those provided by specialized training, which has “no effect on the productivity of trainees that would be useful in other firms” (ibid, p.26). In this paper, I take labor mobility as an indication of workers’ general skills and, conversely, low mobility as an indication of workers’ specialized skills.

Having reviewed the theories underpinning feminization, skills and its relationship to technological changes, I now turn to the main question of my thesis that the literature reviewed so far have left unanswered. Have women’s work within assembly lines been deskilled of manual labor with automation?

Technology

Technology can be understood in a myriad of ways. The most common use of the term is its reference to artifacts or machines. However, other authors have taken a more anthropological or sociological approach to the meaning of technology. Michel Foucault, for instance, understood technology to be “a whole set of social techniques that become institutionalized” (Lerman et al 2003, p.2). Following in this line, other authors have taken a ‘network’ view of technology, arguing that technology is not embedded within the artifacts themselves but, rather, is a system of political, economic and social systems which enable the artifacts to function (Hughes 1983).

In this paper, I take technology to mostly refer to the process of automation on the shop floor in the electronics and textile firms— the machines and the resulting changes in work processes. While not denying that the social context, for example, industrial relations, manager-worker relations on the shop floor, employment policies etc., is important in enabling the implementation and mediating the effects of automation (and, hence, can be taken to be part of the technology), I focus predominantly on the artifactual aspects of the concept and its direct effects on women assemblers. This sets the study apart from socio-historical and anthropological works, which focus on the role of human agency in mediating technological changes. Doing so allows me to provide a macro view of the relationship between automation and women’s skills, which then opens the door for more detailed analysis.

Women and Technology: A Theory of Deskilling and its Consequences

In *Gender, Development and Globalization: Economics As If All People Mattered*, Beneria describes how, amongst the varied implications of technological change on women within the export-oriented industry, some experience limited gains. For instance, a study by Fussell (2000) on the maquiladora industries along the U.S. - Mexico border shows how “high tech production systems have benefitted male labor, thus decreasing the proportion of women workers from its peak in 1985”. Similarly, a study by Berik (2000) on Taiwan, using industry-level panel data, demonstrates that greater export orientation during the 1980s coupled with technological change was accompanied by a “disproportionate loss of employment opportunities for women and an increase in gender wage inequality”. Indeed, “in industries that underwent faster technological change women wage workers experienced both absolute [wage] losses and losses relative to men”. Beneria concludes that “[t]his reversal of feminization due

to the introduction of new technologies in the maquiladora industries, in Taiwan, and other cases occurs for a variety of gender-biased reasons; they include men's greater opportunities to upgrade their skills and to benefit from the introduction of high technology". She attributed the greater training opportunities available to men to the constraints of domestic responsibilities women face (Beneria, p.127).

Implicit in Beneria's argument is the notion that technological change in export industries deskills women because the introduction of new technology requires new sets of skills, which women have little opportunity to obtain, and renders previous ones obsolete. Consequently, gender wage inequality increases and the proportion of women in the industrial workforce decreases or, in her words, an observed process of "de-feminization" as men replace the deskilled women occurs (ibid, p.128).

This paper attempts to address the similar subject analyzed by Beneria on the impact of technological change on women assemblers' skills. However, it takes a different perspective. The hypothesis here is that when new technology is introduced, in this case automation and flexible production systems, assembly work associated with women becomes less reliant on manual dexterity, which factory employers saw as advantageous during the labor-intensive export-production phase. Manual work is replaced by work to operate machines, which does not require dexterity. At the same time, employers are motivated to reduce the number of manual laborers to reduce production costs and to increase profit. Thus, assembly work, initially associated with women, becomes less gendered in character. This could either be due to its gradual increase in availability to and uptake of men or a mere reduction in women workers due to the reduced reliance on manual work with automation. Either way, women's

participation in the relevant workforce relative to men would decrease. At the same time, because women are less in demand in assembly or low-level production work, their wages would decrease relative to the period before automation. This need not necessarily be an increase in gender wage inequality.

While the argument here regarding wage inequality does not necessarily contradict Beneria's, it is important to spell out the differences. Beneria assumes that women workers earn less compared to men. Given this, she argues that gender wage inequality increases with technological change because men have greater access to skill upgrading and, consequently, are in greater demand compared to women. I do not assume that women necessarily earn less relative to men. Hence, I posit that women's wages merely decrease relative to the period before automation. If this decrease is observed, it is because women are less in demand by virtue of the fact that competition with men for the same occupation increases or that women are just less in demand as employers attempt to reduce the workforce. In other words, women no longer have the advantage of manual dexterity to command relatively higher wages. At the same time, if women are given access to training or education, we would expect greater job mobility and an increase in better quality occupations, such as managerial, administrative or clerical positions after most firms automate. In short, while Beneria argues that technological changes deskill women's work of manual dexterity and, thus, lead to the supply-side problem of women laborers with new skills, I argue that, in the Malaysian electronics and textile sectors, deskilling led to a decrease in women labor on the demand-side as employers have less reason to preferentially hire women or to increase hiring itself. This need not necessarily lead to a decrease in the *overall* participation of women in the labor market as women can find employment outside factories.

To summarize, we can compare the two different positions on the effects of technological change on the skills required for assembly work associated with women as follows. If the argument is that technological changes have deskilled women's work of manual dexterity but, at the same time, have re-skilled women with other abilities, for instance, literacy and numeracy, needed for the operation of machines, then the expected observation is lower relative demand for and, hence, decreasing wages for women assemblers with manual skills as employers have little reason to preferentially hire them since men or machines too can perform the job. At the same time, because women are more literate and numerate, there should be greater job mobility. Thus, we would expect the proportion of women in assembly work to decrease while that in other occupations requiring more cognitive skills should increase. Consistently, the relative wages of women assemblers should decrease while their wages in other occupations should increase as women are re-skilled for other jobs. The overall education levels should also increase.

However, if the argument is that technological changes have merely resulted in the deskilling of women's work without opportunities for re-skilling women workers, as Beneria argues, not only should the proportion of women assemblers decrease, the overall participation of women within the labor force should also decline or, alternatively, there would be an increase of women in self-employment or casualized labor. The wages of women assemblers would decline as they are less in demand. The education levels of women should not change much or may even decline as women are not given re-skilling or general educational opportunities. Consistently, labor mobility should not be observed.

In sum, unlike Beneria, my hypothesis to the question of whether women's work is deskilled with automation is in the negative. I propose that women's work and, by extension, women workers are not deskilled per se with automation. Rather, they gain new sets of skills which enable them to find employment outside assembly work.

Methodology

To answer the question of how technological changes along the production lines of the electronics and textile sectors in Malaysia have affected the skills of women workers, I draw macro-evidence from both existing literature and official data. Existing literature will be used to qualitatively describe the changes in the work process and the tasks of women assemblers. The vast amount of research by other scholars allows me to use them to make qualitative description of the work process in general. I do not delve into the specificities of firms or necessarily draw on individuals' experiences. Rather, I analyze the general trend amongst electronics and textile firms. The macro view allows me to draw a broad conclusion, upon which future research can build on to refine and readjust the focal lens.

Because this research is broad and inter-sectoral, I draw on macro data from LABORSTA, the database of the International Labour Office, the Malaysian Plans and government industrial surveys. They are used to make quantitative comparisons between the earlier and later phases of export-oriented industrialization, i.e. between the late 1970s/ early 1980s and the late 1980s/ early 1990s. The data include time series on the proportion of working women and of women assemblers relative to men, wages of women relative to men assemblers, relative wages of women in other occupations and women's average educational levels.

CHAPTER 3

PHASE I INDUSTRIALIZATION

Malaysia's electronics and textile sectors grew rapidly between the 1970s and 1990s, creating labor shortage and, thus, a demand for workers. During this period, the government sought to develop an export-oriented industrialization program to replace an earlier model based on import-substitution and commodity exports, which failed to reduce rural poverty and unemployment. The electronics and textile sectors were the two main sectors that developed in this period because both were given government support, being initially labor-intensive, and had firms in developed countries which were expanding overseas in search of cheaper labor. The share of production output and employment within these sectors vis-à-vis other manufacturing sectors is indicative of their rapid growth. In 1970, the electronics and textile sectors accounted for only 7.3 and 3.8 percent respectively of total manufacturing output. By 1980, the electronics sector became the second largest sector, accounting for 11.4 percent of output while textiles made up 6.6 percent. In terms of employment, the electronics and textile sectors employed 2.3 and 6.2 percent of manufacturing workers in 1970 but 16 and 12.7 percent respectively in 1980 (Rasiah 1995, p.83). Thus, as a result of such rapid growth and the tightening of the labor market, the government mobilized vast numbers of rural workers into production work to meet demand.

Employment Pattern – Phase I

At the initial phase of the export-oriented industrialization program, roughly between the 1970s and mid-1980s, nearly all firms that came to Malaysia were relocating their labor-intensive production process to developing countries for access to cheaper labor.

Thus, the work processes within these factories were characteristically labor-intensive, involving mostly repetitive manual assembly work with little technological input. In Malaysia, as in most Southeast Asian countries, the production workers employed were predominantly female. A case in point is an Intel plant in Penang, the country's semiconductor 'hub', where women made up 90 percent of the assembly workforce between the late 1970s and early 1980s (Grossman 1979, p.3). The reasons for this can be explained both in terms of the government's efforts to encourage employment of rural women workers and the demands of multinational firms (henceforth MNCs) for cheaper labor.

During this period, the government welcomed such production factories because they were distinctly labor-intensive. This, as the government at that time thought, would help in alleviating the problem of unemployment. As one Malaysian government official cited by Grossman aptly put, "[these firms] are so fast moving. They come in and quickly soak up people" (1979, p.8). Rural women workers were promoted as having the necessary qualities of dexterity, docility and quick learning abilities. This attitude is clearly reflected in a now oft-quoted advertisement to MNCs by the government at that time which made the following claim;

The manual dexterity of the oriental female is famous the world over. Her hands are small and she works fast with extreme care. Who, therefore, could be better qualified by nature and inheritance to contribute to the efficiency of bench-assembly production line than the oriental girl? (ibid)

At the same time, the availability of a reserve of cheap and manageable labor both appealed to and was sought after by MNCs. As Salih and Young note, “when [MNCs] had low levels of capital, there was a need for large numbers of workers [which] had to be cheap and manageable, which meant that women were preferred”. The “docile personalities” of women were sought for “in the expectation that they would not resist long hours of monotonous and repetitive work on the assembly line” (1989, p.67). Narayanan and Rasiah also suggest that women workers were predominantly employed for production work within the electronics and textile sectors not merely because of lower wages but also because “unorganized women everywhere were more likely to be tolerant of work that is low-paid, relatively unskilled, monotonous and unstable” (1992, p.79). The need for not just cheap but also manageable labor is aptly captured by a quote from a personnel officer of Intel in Malaysia, who stated that “[Intel] hire girls because they have less energy, are more disciplined, and are easier to control” (Grossman 1979, p.2).

Thus, from the 1970s, the labor force of the assembly line in Malaysia was feminized with rural women workers comprising the majority of production workers in manufacturing firms, as these authors describe. A large proportion of women workers were employed within the electronics and textile sectors (Figure 3.1 and Table 3.1).

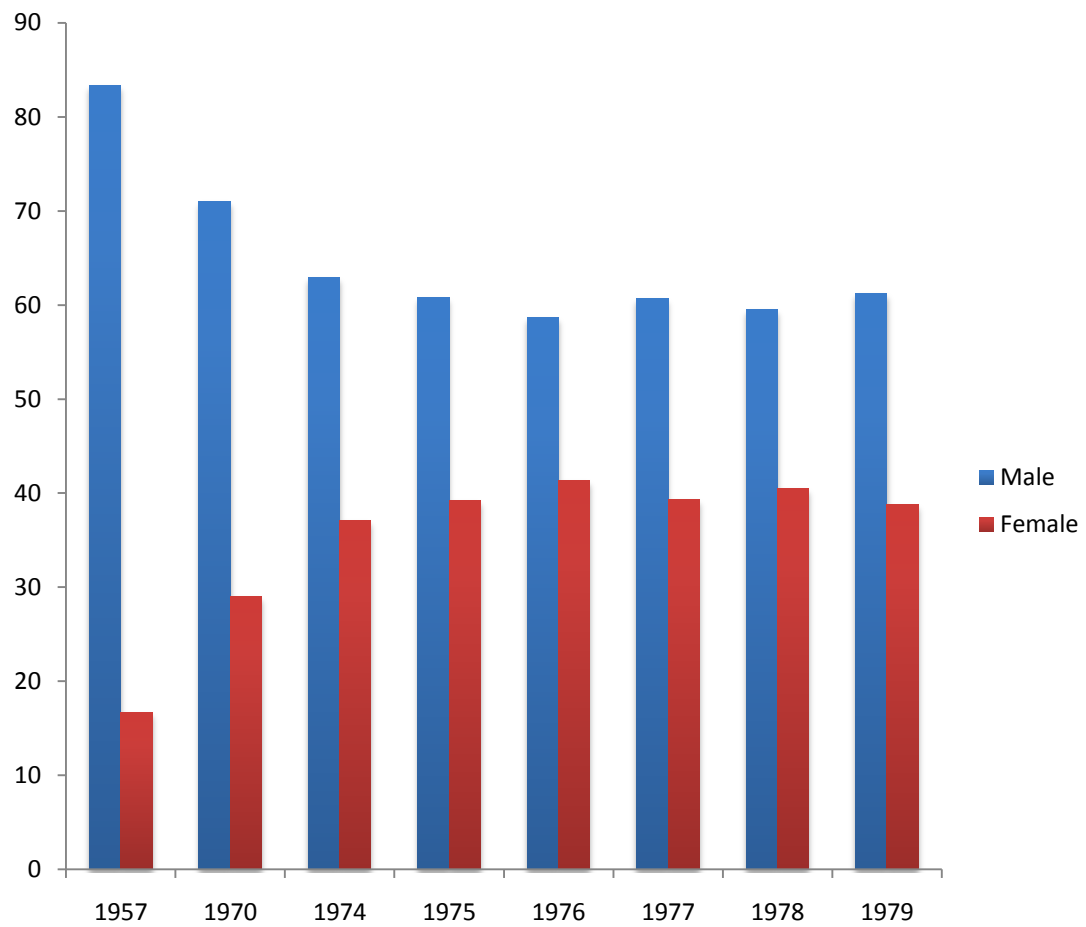


Figure 3.1

Proportion of Employed Male and Female Workers in the Manufacturing Sector in Peninsular Malaysia (1957-1979)

Source: Malaysian Government, National Family Planning Board, Malaysia (1983, p.38)

Table 3.1

Female Employment Growth and Proportion of Female Workers in the Electronics and Textile/ Garment Sectors in Phase I of Industrialization

Source: Taylor and Ward (1994, p.143)

Industry	Female Employment Growth (1970-1980)	Proportion Female in Sector (1980)
Textiles	211.0	62.1
Footwear and Clothing	146.8	76.7
Electrical Equipment	5,877.8	73.2

Work Process – Phase I

As noted earlier, the electronics and textile firms that established production plants in Malaysia from the 1970s predominantly relocated the assembly processes to the country. Within the electronics sector, some of the products assembled include “integrated circuits, resistors, filters, electron tubes, capacitors, condensers, inductors, transformers, transistors, relay coils and printed circuit boards” which are used in the manufacture of consumer and industrial products such as “radio and television sets; cassette players; musical instruments; calculators; computers; pocket paging systems, telephone answering devices and other communication equipment and apparatus”. The production process mainly involved the “assembly and testing of integrated circuits and other electronics devices using raw materials such as chips and wires”. Work included the “mounting of the chip on a frame [and] the welding of appropriate wires to it and the enclosing of the device in a resin, plastic or ceramic casing”, after which the component is tested (Labour and Manpower Report 1988, p.75).

To illustrate, in the assembly of microscopic electronics circuits, semi-skilled and unskilled women workers slice silicon wafers, two to four inches in diameter, into separate chips. They then bond the chips to circuit boards using microscopes. As many

as 50 gold wires, “no thicker than a strand of human hair”, is manually bonded to the die-pads per day for seven to nine hours. Other workers seal the chips inside a plastic or ceramic-protective coating before baking them in 600-1000°C ovens. These components are then checked by testers who dip them in tanks of chemical before applying electric currents (Ariffin 1994, p.77, Mohamad 1998, pp.97-98).

Because the objects that are handled are microscopic in size, these tasks were “narrowly dexterous in skill terms” requiring a great degree of hand and visual precision (Mohamad 1998, pp.97-97). Evidence of this comes from reports of women workers complaining of eye-strain (Goodman 1987, p.75).

In the textile sector, job functions required workers to “prepare natural textile fibres for spinning and winding; spin and rewind thread and yarn; set up and maintain various kinds of looms and knitting machines; prepare pattern cards; weave and knit various kinds of textile fabrics and bleach, dye and treat textile products”. Workers also had to “make and alter garments; perform hand or machine sewing tasks in the manufacture of ready-to-wear clothing and make patterns as well as mark and cut materials” (Labour and Manpower Report 1985, p.138). The most labor-intensive of these processes were the sewing, knitting and weaving jobs, which required high dexterity. According to Rasiah, “[i]n the 1980 when none of the textile and garment firms had automated machinery, dexterity was the prime skill” Indeed, “new recruits had to pass dexterity tests [with] the most dextrous recruits... trained into sewers (in garment firms) and menders (in weaving and knitting firms)” (1993, p.17).

Skill Profile – Phase I

Because assembly work within the electronics sectors in the early phase of export-oriented industrialization required a high degree of task-specific manual skills and did not depend much on cognitive abilities, many of the women workers only had education of 11 years or less. In other words, these workers only acquired primary or, at most, secondary education (Labour and Manpower Report 1988, p.76). The specificity of the skills required also meant that most training given was on-the-job, which impeded job mobility to other clerical, administrative or supervisory occupations. As Narayanan and Rasiah argue, “given the high degree of specificity of the training imparted, there was little scope for moving up the ladder [and] long-term career development prospects were dim” (1992, pp.82-83).

This was also true of the textile sector in which the bulk of laborers were in production work and only possessed primary or secondary education. Indeed, the Labour and Manpower Report of 1984/5 noted that “in most cases, paper qualification [were] not a prerequisite” and that “[r]ecruitment [was] normally based on recommendations by existing workers. In addition, “training... [was] conducted almost exclusively in the plant and generally on-the-job under the supervision or guidance of a foreman or an experienced worker” and was generally “of a short duration ranging from a few days to a few months depending on the requirements of the job”, emphasizing “the acquisition of certain manipulative skills and some related theoretical knowledge” (1984/5, p.142).

In sum, during the early phase of export-oriented industrialization, the production workers possessed manual skills, for instance, dexterity and visual precision that were

job-specific. They need not have possessed cognitive abilities to be employed as assemblers. Consequently, these women often faced dim job improvement prospects since the skills they possessed were not easily transferable to other occupations or jobs. Most non-agricultural female workers were employed as production operators. For instance, in 1970, only 4.1 and 0.1 per cent of employed female workers occupied administrative and managerial and clerical positions respectively while 10.4 per cent were in production positions, second only to agriculture work which accounted for 66.8 per cent of female employment (Malaysian Government 1991, p.416).

CHAPTER 4

PHASE II INDUSTRIALIZATION

Technological Changes in the Assembly Line

By the mid-1980s, most electronics firms began to automate due to international pressures to increase production and the tightening labor market. Thus, by 1990, most firms had automated more than 90 percent of the production process including dicing, die-attaching, bonding and moulding (Narayanan and Rasiah 1992, p.84). These machines “mount circuits onto metal frames, wire the circuits in place and test the products for flaws”, increasing productivity and reducing spoilage and wastage (Labour and Manpower Report 1988, p.76). For instance, a company in Penang, which could produce 2000 units of semi-conductors in 1981, could, by 1989, produce 11,000 units. The dependence on laborers decreased dramatically. Another firm in Penang claimed that with automation, one worker could man up to eight machines when previously she could only man one (Salih and Young 1989, pp.61-62).

Consequently, the image of rows of women workers manually assembling microscopic components became replaced by one of women manning machines. As the Labour and Manpower Report of 1985/86 notes, “the picture of women workers performing repetitive manual assembly operations with the aid of microscopes is becoming a thing of the past in most electronic factories. The assembly line today consists of sophisticated machinery... Present day operators are being trained to monitor such machines rather than physically doing the work themselves” (1988, p.76).

The same is observed in the textile sector. A survey conducted by Rasiah shows that a majority of firms in Penang surveyed had at least some automated machinery by 1989. Nearly all fiber-making, spinning and weaving firms surveyed started using air-jet looms while several had automated pirn-winding in yarn-making, fabric scanning and embroidery making. Others used computer-controlled cad-cam machines for plotting and fabric cutting. Employers interviewed said one of the main reasons for automating production was to “improve efficiency and check falling reserves of labor brought about by competition for workers”, the same reasons given by employers of electronics firms. Garment firms also cited rising fiber costs and the resulting need to reduce wastage as the prime reasons for automating (Rasiah 1993, pp. 13-16).

Work Process – Phase II

With automation of processes like dicing, die-attaching, bonding, checking and testing, women assemblers of electronics firms now mostly man machines, using television screens to view the chips handled. In addition, these processes have become more complex and the chips handled miniaturized such that manual work is nearly impossible. For instance, the bonding process now involves more wire attachments as the chips became more complicated (Salih and Young 1989, p.67). As Narayanan and Rasiah observe, “repetitive manual operations have been reduced to monitoring machines that automatically weld, bond, crimp and fuse parts into a finished semiconductor device” (1992, p.89).

The trend of a shift from manual work requiring dexterity to the manning of machines is also observed amongst production operators in textile firms. For instance, weaving operators now handle machines rather than carry out manual weaving. Designs are also programmed to size through cad-cam machines so that the “technically skilled

cad-cam machine operators have displaced the skilled draughtsmen”. These programs are then linked to other automated machines, for instance, cloth cutters. In garment firms, automated scanners are used to improve identification of marks and color uniformity so that the subjective judgment of workers is less relied upon. Instead, the worker now programs and mans these scanners. Semi-automated sewers also stitch clothing peripherals (e.g. zippers, sleeves and pockets) so that the worker only programs the machine and feeds the cloth (Rasiah 1993, p.18).

The increasing use of automation, then, has generally displaced the need for manual skill as work is now mostly programmed into and performed by the machine. As Narayanan and Rasiah observe, “where automation has evolved, the evidence tends to suggest the displacement of old skills (especially dexterity)”. They point out that “it is the mundane and fragmented dexterity and visual skills which appear to be the most obvious skills replaced” (1992, p.91). Fong and Lim observe a similar pattern noting that “where automation is feasible or economic, it usually makes the visual, manual and decision-making skills of the operator less important, while raising the demand for maintenance skills and machine tenders” (Fong and Lim 1989, p.45). For instance, in textile firms, skilled menders who spot and mend breaks in weaved and knitted cloth become redundant as the work is now accomplished by machines. Scanners to identify marks and color uniformity in fabric have also displaced workers’ visual skills by making these skills obsolete (Rasiah 1993, p.18).

Skill Profile – Phase II

An important issue in light of the displacement of manual skills of women workers in electronics and textile firms is whether these have been replaced by new skills and, if so, what the implications are. Narayanan and Rasiah argue that “far from deskilling

the worker, the trend has been to equip the worker with high technology skills [which include] cognitive and statistical skills that have... broadened the scope for thinking” (1993, p.91). Rasiah further argues that computer programmers in textile firms who no longer tend to manual work are now equipped with skills that involve considerable problem solving (1993, p.18).

An implication of the displacement of manual skills with greater intellectual capacity is that the general numeracy and literacy level of workers increases. Indeed, these authors have observed that the minimum qualifications of production operators have increased. It is also expected that, with greater transferable skills such as numeracy and literacy, job mobility of women to other occupations increases. I provide the relevant evidence in the following chapter.

Employment Pattern – Phase II

The first phase of industrialization within the electronics and textile sectors saw an increased proportion of women production workers because they were deemed suitable for repetitive assembly work, in terms of skills, character and low demand for wages. However, with many of these processes automated, we expect a decreased dependence on women workers as these manual skills are no longer required. Several authors have noted that “technological innovation and automation may lead to a decreased demand for labour” (Goodman 1987, p.76) and, in particular, a reduction of the proportion of women workers previously involved in manual work processes (Narayanan and Rasiah 1992, pp.88-89). Consistently, we also expect women’s wages to decrease relative to men’s as their possession of manual skills becomes less of a comparative advantage. I explore and provide evidence of these trends in the following chapter.

CHAPTER 5

EMPIRICAL DATA & ANALYSIS

From the mid-1980s onwards, there has been a general decline in the proportion of women workers in the textile and electronics sectors (Table 5.1). The evidence here suggests that automation in related factories have made the production process less reliant on manual skills, dexterity and visual judgment, previously associated with women, because these techniques are now programmed into the machine.

Consequently, employers have less reason to selectively employ women as men too are seen as equally capable of performing these jobs. The evidence also does not contradict the idea that employers, in their bid to reduce costs, decrease the overall work force, the majority of whom are women.

Table 5.1

Ratio in Percentage of Women to Total Employment in Selected Manufacturing Sectors, 1986-1994

Source: Author's calculations from LABORSTA data

Sector	1986	1988	1990	1992	1994
Textiles	65.43	63.89	57.63	54.02	48.97
Apparel	89.15	87.66	85.29	85.99	80.95
Electrical Machinery	75.87	78.10	75.36	72.95	69.57

Data on the relative wages of women assembly or production operators, however, provide more support that women's decreased participation is more a result of employers' lower preferential employment of them than a general decrease in employment. This is as if the decrease in women workers is merely a result of a general reduction in employment, the relative wages of women compared to men should not change much. However, this is not observed. Instead, women's relative wages compared to men within the same occupations show a slight decrease from the late 1980s/ early 1990s onwards in both electronics and textile firms (Table 5.2, 5.3)¹. There are two possible explanations for this. As employers have a larger pool of laborers to hire from, the demand for women workers, and, thus, their wages, fall proportionately. Alternatively, women have a reduced advantage in leveraging on their skills to command higher wages as work processes become less dependent on the manual skills they were seen to possess.

¹ It is interesting to note the increase in relative wages of women in supervisory and foremen positions. One way to understand this is the increase in women's educational levels that have enabled them to command higher wages at these occupational positions.

Table 5.2

Average Monthly Earnings of Women as a Ratio in Percentage to Men's in the Textile Sector in Selected Occupations, 1974-1995

Source: Sixth Malaysia Plan and LABORSTA

Occupation	1974	1980	1989	1990	1995
Production Supervisor and Foreman	66.2	69.7	N/A	75.2	N/A
Thread and Yarn Spinner	85.6	101.7	89.6	93.8	76.6
Fiber Rover	88.5	87.0	N/A	103.0	N/A
Machine Cloth Weaver	126.9	74.7	90.9	111.0	103.3

Table 5.3

Average Monthly Earnings of Women as a Ratio in Percentage to Men's in the Electronics Sector in Selected Occupations, 1974-1995

Source: Sixth Malaysia Plan

Occupation	1974	1980	1990
Supervisor and Foreman	55.5	62.1	82.8
Production Operator	N/A	97.4	82.7

So far, then, data on women's relative wages and employment support my (and Beneria's) thesis that technological changes have placed women at a disadvantage because assembly work, once seen as reliant on the manual skills women possess, no longer is characterized as such by employers. Indeed, data in Table 5.4 reflect this notion of 'de-feminization' with a decline in the proportion of women production workers from 1990.

Table 5.4

Ratio in Percentage of Women to Total Employment in Selected Occupations, 1980-1995

Source: Author's calculations from LABORSTA data

Occupation	1980	1985	1990	1995	1998
Professional, Technical and Related Workers	38.31	41.47	46.58	43.56	43.88
Administrative and Managerial	6.01	8.67	12.09	18.81	19.47
Clerical and Related Works	42.90	50.35	51.49	54.42	57.18
Sales and Related Works	28.77	34.38	33.72	35.92	36.10
Service Workers	41.00	41.74	43.47	44.02	46.07
Agricultural Workers	39.79	38.21	33.98	27.95	26.34
Production and Related Workers	22.58	22.24	28.43	25.38	22.76

However, what is less clear is whether these women have mostly been displaced out of the workforce because they have completely lost their manual skills without gaining any new abilities, gained other skills that also enable them to obtain higher quality jobs or been pushed into unstable home-based self-employment or subcontracting work.

If women have mostly been displaced out of the workforce, we would expect to find a drop in the proportion of women within the labor force. However, this is not what evidence suggests (Figure 5.1). The proportion of women in the labor force from the mid-1970s to the mid-1990s has stayed mostly stable, even increased marginally from 32 to 35 percent. Thus, it is unlikely that most women assembly workers have been displaced out of the workforce as a result of deskilling through automation.

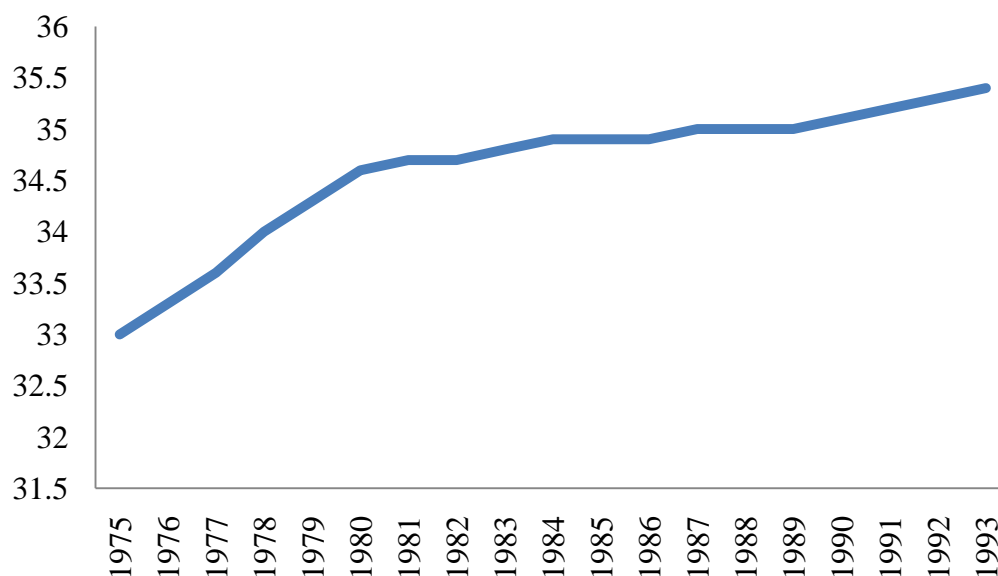


Figure 5.1

Proportion of Women in the Labor Force, 1975-1993

Source: World Bank (1995)

The second explanation is that, with technological changes, women have been able to gain other skills like numeracy and literacy, which are required to man the machines. At the same time however, their employment in assembly work declines because these new skills are not seen by employers as specific to women. Employers, then, have a larger pool of laborers from which to hire and men now compete with women. Some of the displaced women are able to obtain higher quality occupations, thus accounting for the larger proportion of women in clerical, administrative, sales and professional occupations. The new skills gained in terms of literacy and numeracy, then, can be thought of, in Becker's terms, as general skills which enable women to move into other occupations. Skills that are more specific because they cannot be applied outside production occupations, like dexterity for bonding, welding and the cutting of

garments, become less important. Most literature cited in the previous chapter support this position. Evidence showing an increase in women's educational opportunities (Table 5.5, 5.6, 5.7) and in the proportion of women workers in higher quality occupations, such as managerial, clerical and administrative positions (Table 5.4) also supports this view.

Table 5.5

Percentage Enrolment of Female Students According to Level of Education,
1970-1980

Source: Sixth Malaysia Plan

Education Level	1970	1980	1990
Primary	46.8	48.6	48.6
Secondary	40.6	47.6	50.5
Post Secondary	42.6	45.5	59.3
University	29.1	35.5	44.3

Table 5.6

Percentage Female Literacy Rates of Adults and Youths, 1980-1991

Source: UNESCO Institute for Statistics

Age	1980	1991
Adults (> 15 years)	61.2	77.3
Youths (< 15 years)	86.5	95.2

Table 5.7

School Life Expectancy of Females from Primary to Secondary Education*,
1975-1995

Source: UNESCO Institute for Statistics

(*Reflects the probability the considered group would spend in education, i.e. the expected number of years spent in education)

Year	1975	1980	1985	1990	1995
School Life	8.3	8.7	9.7	9.6	10.1

Several qualifications need to be made. During the period between the late 1980s and early/mid 1990s, when the economy was booming, Malaysia faced a problem of labor shortage across various non-agricultural sectors. Thus, this problem could have contributed to the observed increase in women's employment in other non-agricultural occupations outside production work. A deeper analysis to provide a firmer conclusion, then, would track the employment of women who were laid off from factory work.

Another important finding, which suggests that the work process has not been completely deskilled, is from studies on women in casualized labor. Some of these works show that women have been displaced out of factory assembly work into casualized labor so that more women work from their homes, either on their own account or through subcontracts linked to MNCs. Here, the distinction between own account or self-employed workers and those who work from the home but through subcontracts is crucial. Women who work independently on their own account or as family workers can be regarded as self-employed. In this case, women workers use their own resources to produce goods. Workers who work from their homes but through subcontracts however, work with resources provided by the firm they subcontract with. They usually work with machinery and materials provided by the firms and are paid a piece rate, i.e. by the number of products they produce in a day.

Although data on self-employed women is scarce because much of women's work based in homes remains obscure and, thus, not included in surveys and census, a few studies have begun to look at them. Table 5.8 shows that the proportion of the female labor force in non-agricultural self-employment in Malaysia has decreased. A large

part of this decrease is reflected in the industrial labor force. Hence, the possibility that automation, and the resulting deskilling of manual labor by women assemblers in factories, has displaced these workers out of formal into self-employment is low based on the information below.

Table 5.8

Proportion of the Female Labor Force in Non-Agricultural, Industrial and Trade Sectors, 1980-1990
Source: Charmes (1999)

% Self-Employed in Selected Labor Force	1980		1990	
	Total	Female	Total	Female
Non-Agriculture	21.2	18.8	17.9	17.8
Industry	17.8	16.2	9.6	9.6
Trade	52.2	47.2	47.2	47.2

A different picture, however, emerges from studies on women who work based on subcontracts. A report of an ILO Conference notes that a survey, carried out in the late 1980s, of 3000 manufacturing firms in Malaysia showed that “over a third of all electronics, textile and garment firms were seen to have subcontracted out part of the production work”. It adds, “interestingly, the larger the firm size, the higher was the incidence of such subcontracting” (ILO 1995, p.9). Thus, if this observation can be generalized beyond the 3000 firms surveyed, it can be argued that, while technological changes have deskilled women’s work in the factory of their manual labor, it has not completely deskilled the work process such that women’s abilities are redundant. Women still do find employment as production operators but outside the formal factory work force, perhaps as a consequence of employers’ efforts to reduce labor costs. The question, then, to determine whether new skills are gained or whether old ones are still required, is what types of work processes women are involved with

subcontracting. More detailed surveys of women working from their homes may be needed to support this argument.

To summarize, the evidence provided supports the idea that automation per se has not completely deskilled women workers, contrary to Beneria's findings on Mexican women. These workers appear to have gained other skills such as numeracy and literacy, required to man the machines, as reflected in their increased educational levels and mobility to other occupations requiring more cognitive abilities like clerical, sales and, to a lesser extent, managerial work. The reduction in the proportion of women assemblers can be explained by the fact that employers have a larger pool of workers to hire from since these new skills are seen as less gendered in character.

Even if the increased proportion of women workers in non-assembly/ agriculture occupations is predominantly accounted for by a shortage in labor supply during the booming years of the Malaysian economy in the late 1980s and early/mid 1990s, the survey on women home workers suggest that they still do find employment and that their skills are not completely redundant. The difference, however, is that with automation, employers utilize more precarious forms of employment for women.

CHAPTER 6

CONCLUSION

The macro evidence gathered in this paper suggests that Malaysian women workers and their work are not de-skilled per se with automation in electronics and textile factories, despite their reduced proportion of employment in assembly work. Instead, data suggests that women do gain other skills, as reflected in their increased participation within the labor force. The findings suggest that there are two areas in which women are moving into. One, with greater numeracy and literacy skills, women are finding employment in better jobs like clerical and sales positions. Two, other women could be pushed into more vulnerable forms of employment through subcontracting. In this case, women still contribute their skills in assembly work but operate from their homes in more informal settings.

This finding differs from Beneria's, which focuses on Latin America, in large part due to the unique problem of labor shortage which Malaysia faced. As a result of this shortage, women had to be retrained on-the-job by employers and given increased educational opportunities by the government to meet the soaring demands of the manufacturing industry. Women who were displaced with the implementation of automation could still find other forms of employment, either in better occupations such as clerical/ managerial work or in casual housework.

Finally, the data collected pose some limitations to the conclusions that have been drawn. One, while data does show an increased proportion of women workers in clerical and sales occupations and subcontracting work, it is not clear whether some of

these women were actually displaced from factory assembly jobs. Further research could focus on a labor mobility study to track exactly which occupations these displaced women assemblers are moving into. If more women are displaced into informal subcontracting work in assembly operations, yet employers claim women's skills are not needed by formally reducing employment, policy should be in place to protect these workers. Two, the macro data used does not show whether women working from homes are performing the same types of work before automation or whether they are different. A micro study would help provide a clearer picture.

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Electronic Resources

LABORSTA, available online at < <http://laborsta.ilo.org/>>